PLANKTON OF THE SYDNEY WATER-SUPPLY.

By G. I. Playfair.

(Plates liii.-lvii.)

The Sydney Water-Supply is the water of the Nepean and Cataract Rivers, which is impounded in the Cataract Reservoir, and thence brought down, by many miles of canal, through the Prospect Reservoir to Guildford and Pott's Hill, where it is filtered by being passed through a double series of wire-screens. These screens being periodically raised and washed with a hose, the effluent from this operation has been the principal source of material for the following notes. A few samples have also been taken from the pond at Pott's Hill and various tanks in the Botanic Gardens, the water of which has the same origin.

While incidentally determining the flora and fauna of the plankton, one main object of this investigation has been to search for the *Phythelieæ* and *Rhizosolenia.* This object has happily been attained, and, although the *Phytheliecæ* were not too plentiful, a very interesting series of forms has been brought to light, both these and *Rhizosolenia* being represented in the plankton at all seasons. It was originally intended to take a considerable number of samples, and pay some attention to the fluctuations in the contents of the plankton; but, at the very outset, it was seen that the plankton was practically constant all the year round.

The suspended matter separated from the water by the filter-screens divides naturally into five parts: (1) *Melosira granulata*, (2) Vegetable débris, (3) Peridinieæ, (4) Filamentous algæ, (5) All the lighter organisms.

(1)*Melosira granulata.*—This diatom accounts for an overwhelming proportion of the total solids, being in vastly greater quantities than all the rest put together. Indeed, it was necessary to allow the effluent from the washing of the filters to precipitate for half an hour to get rid of some of the *Melosira.* I am at a loss to know where it all comes from. *Melosira granulata* is quite rare in all the swamps and marshy places round Sydney, which I have examined, and it is not strikingly more common in creek-pools.

(2)Vegetable débris.—There does not seem to be a very large proportion of vegetable débris, but no quantitative investigations were undertaken.

(3)Peridinieæ.—At every season of the year, there is to be found a splendid assortment of Peridinieæ in relatively large numbers.

(4)Filamentous algæ.—These are not well represented, nor in any quantity; but, at certain seasons, enough green matter is brought down to form into gouts when the screens are hosed. These consist chiefly of *Spirog. porticalis*, *Mougeotia* sp., *Bulbochæte setigera*, *Oedogonium* sp., *Zygnema* sp., *Calothrix confervicola*, *Scytonema mirabile*, *Osc. nigro-viridis*, with the filamentous Desmids, *Hyal. mucosa*, *Desm. Swartzii*, and *Desm. pseudostreptonema.*

(5)Minute organisms.—When the superfluid was poured off, the lighter portions of the plankton appeared as a whitish-green, flocculent deposit upon the thick tenacious slime of *Melosira*, from which there was no difficulty in separating it. On account of the richness of the material dealt with, it was not necessary to use more than ordinary decantation in order to secure the *Rhizosoleniæ* and *Phytheliea.*

With regard to these two, the *Phytheliea* were scarce, and need to be diligently searched for; but *Rhizosolenia eriensis* var. *morsa* was in great abundance, the field of the microscope being sometimes crowded with frustules. The origin of the swarms of this diatom, is a mystery greater even than that of the *Melosira.* I have never, at any time, found *Rhizoso-*

lenia eriensis in either swamp or creek or pond, save that I found a single frustule in the pond at Pott's Hill, which, however, has been formed entirely by a scour from the filter-screens.

It was abundantly evident, from the general character of the plankton, that the water of the Supply is mainly derived from the storm-water brought down by a multitude of creeks to the river, and not from the drainage of swamps. The microscopic flora is just such as I have often squeezed out of the heads of tufty weeds in creek-pools. Further evidence to the same end is afforded by the gratifying absence of *Anabæna*, of which I cannot remember to have noted a single filament, and of *Trachelomonas* among the Infusoria, two organisms, which, I think, may be considered as characteristic of swamp-life in this country. Indeed, with the exception of *Oscillatoria nigroviridis* var. *crassa*, and *Scytonema mirabile*, the Myxophyceæ are conspicuous by their absence.

The following synopsis will serve to show the general balance of parts in the flora and fauna of the plankton. The numbers indicate species and well marked variations; this makes the Desmids appear more numerous than they really are.

Flora.		Fauna.	
Chlorophyceæ generally ...	60	Peridinieæ	13
Desmidiaceæ	112	Infusoria	35
Myxophyceæ	19	Rotatoria	14
Bacillariaceæ	48	Rhizopoda	13
Phythelieæ	16	Vermes	3
		Entomostraca	3

This table, however, gives quite a fictitious idea of the appearance of the material from the filter-screens. The majority of organisms included are quite rare, having been noted to the extent of anything between *one specimen only*, and *one specimen to each drop examined*. Considering the richness of the slimes, the accumulated screenings of 48 hours, this means that they do not bulk very largely in the plankton. The following list gives the forms commonly to be observed in every filter-sample:—

Ar. triangularis, Cos. ellipsoideum var. *intermedium* and var. *minor, Cos. capitulum* var. *detritum, St. connatum* var. *Spencerianum, St. corniculatum β variabile, St. orbiculare* var. *germinosum* and var. *planctonicum, St. approximatum, St. sexangulare* var. *platycerum, St. sagittarium, St. volans* and var. *elegans* and var. *trigonum.*

Pediastrum duplex var. *reticulatum.*

Melosira granulata, Cycl. Meneghiniana, and var. *stelligera* and var. *minutissima, Tab. flocculosa, Rhizo. eriensis* var. *morsa, Synedra subtilis, Vh. rhomboides* var. *neglecta* (*Schiz. neglecta* Thw.), *Gomphonema parvulum, Achnanthes microcephala.*

Osc. nigroviridis var. *crassa, Scyt. mirabile.*

Cerat. hirundinella, Perid. tabulatum var. *granulosum* and var. *Westii* and var. *inconspicuum.*

Anurea cochlearis, Dinobryon sertularia var. *divergens, Bosmina longirostris* var. *cornuta.*

Almost all are quite well known European forms, such, too, as are common in the waters round Sydney, and in other parts of New South Wales.

Notes on, and descriptions of various forms.

PHÆOPHYCEÆ.

Dinobryon sertularia Ehr., forma. (Plate lvii., fig.5).

I am entirely in agreement with Wesenberg-Lund (Biol. Centralbl. xx.) and Kofoid (Plankt. Illinois River), who regard all the variants of *Dinobryon* as forms of a single species. The latter (*l.c.*, Art. ii., pp. 78-79) after enumerating sixteen "species" represented in the plankton, says:—"As the result of my attempts to refer *all of the individuals* which I have seen in my work of enumeration, to *species*, I am of the opinion that we are dealing, in the case of the species of

Dinobryon above cited, with a single variable organism, whose *extremes* of variation only have been regarded as separate species. The connecting links are sufficiently abundant still, and the union of several types in a single colony is sufficiently frequent to lend some weight to my conclusions with regard to those forms which have been under my observation." The italics are Prof. Kofoid's. My own observations abundantly indicate that this is applicable to all aquatic micro-organisms both vegetable and animal. A very common rule is that the genus and the species are one, the accepted "species" being merely forms brought about by varying modes of growth. *D. sertularia* var. *cylindricum* (Imhof), *D. sertularia* var. *divergens* (Imhof), and *D. sertularia* var. *Schauinslandii* (Lemm.) are found in the Sydney Water-Supply (Plate lvii., figs. 6-8).

CHLOROPHYCEÆ.

Genus PEDIASTRUM Meyen.

PEDIASTRUM TETRAS var. LONGICORNUTUM (Rac.). Nonn. alg. nov., T.vii., f.64.

Diam., c.proc. 15; s. proc. 9 μ.

In company with (*Crucigenia*) *tetrapedia*. This form is a variant of *Pedi. tetras* var. *Ehrenbergii*. As found in the plankton, it was plainly the outgrowth of (*Crugigenia*) *tetrapedia* (Kirchn.) W. & G. S. West, which accompanied it. (Pl. lvi., f.1. Compare Pl. lvi., f.8,9, for a similar growth).

Var. AUSTRALE, n.var. (Plate lvi., f.2).

Cœnobium crucigeniæforme, in medio foramine instructum; cellulis 4, subtriangularibus; angulis exterioribus subacutis; margine exteriori medium leviter inflato.

Long.10, lat.8 μ.

The lower cell of the four has not developed *pari passu* with the others. Compare W. & G. S. West, Alg. N. Ire., Pl.i., f.11-12, out of which our form develops.

Var. TETRAPEDIA(Kirchn.) mihi. (Pl. lvi., f.3).

Syn., *Staurogenia tetrapedia* Kirchn.; *Tetrapedia emarginata* Schröd.; *Lemmermannia emarginata* Chod.; *Crucigenia tetrapedia* W. & G. S. West.

Long.8, lat.8 μ.

Var. QUADRATUM, n.var. (Pl. lvi., f.3*a*).

Cellula unica, quadrata; angulis rotundatis; lateribus emarginatis; endochroma in partes triangulares 4, cruce hyalina plus minus divisa.

Diam. 8 μ.

The cell itself does not divide in this form and the next. The chloroplast gradually separates from the centre outwards into four triangular lozenges. In Pl. lvi., f.3*a*, this separation is not yet quite complete, a little band still remaining at each corner; no septa are formed. Var. *tetrapedia* (Pl. lvi., f.3) is the outgrowth of this form.

Var. UNICELLULARE, n.var. (Pl. lvi., f.4).

Cellula unica, circularis, disciformis, in centro foramine instructa. Endochroma homogenea in partes 4 cruce hyalina plus minus divisa. A latere deplanata elliptica, in medio constricta. Diam. 6 μ.

The four preceding forms were obtained in considerable numbers by filtering a few gallons of water from the pond at Pott's Hill. They show the development of a four-celled *Pedi. tetras* out of the resting cell resulting from a zoospore. *Crucigenia* cannot stand as a genus, the species composing it being all infantile growth-forms of *Pediastrum*.

Var. TRIANGULARE(Chod.) mihi, forma. (Pl. lvi., f.5).

Long. 8, lat. 7 μ.

Syn., *Staurogenia triangularis* Chodat. In this form, the central foramen has early swelled into an oblong lacuna causing the component cells to assume a somewhat different shape. There is a form of *Pedi. tetras* also corresponding to this *crucigenia*-stage, the 4-celled cœnobium being rhombic instead of square.

Var. CRUX MICHAELI (Reinsch) mihi. (Pl. lvi., f.6).

Cœn. lat. 20-25 μ.

Duckpond, Botanic Gardens.

Syn., *Tetrapedia Crux Michaeli* Reinsch, Mittelfr. p.38, T.i., f.vi.

The hyaline spaces between the cells are sometimes wanting, the cells being contiguous.

Var. INTEGRUM (Näg.) mihi, forma. (Pl. lvi., f.7).

Cœnobium crucigeniæforme medio lacuna oblonga parva instructum.

Cellulis 4 plus minus cordiformibus, marginibus exterioribus concavis, angulis exterioribus interdum minuto apiculo præditis.

Long. 25, lat. 23 μ.

Duckpond, Botanic Gardens.

Genus SCENEDESMUS Meyen.

SC. OBLIQUUS var. ACUMINATUS (Lag.) Chod. (Pl. lvi., f.8).

Cellulæ endochroma homogenea dilute cœrulea impletæ, pyrenoidibus singulis minutis instructæ.

Cœn. long. 22-30, lat. 16-24; cell. lat. max. $2\frac{1}{2}$ μ.

Cf. Bernard, Protococc. et Desm., Pl. xiv., f.422.

Var. INERMIS, n.var. (Pl. lvi., f.9).

Forma cellulis omnibus oblongis perfecte rectangularibus, interioribus paullo longioribus.

Cœn. long. 16, lat. 16 μ.

Genus OOCYSTIS Näg.

OOC. PARVA W. & G. S. West, Journ. Bot. xxxvii., 1899, Pl 394, f.14-17.

Cœn. oblong. long. 54, lat. 42; cell. long. 10, lat. 8 μ.

Cœn. globos. diam. 12, 18, 24, 48; cell. long. 12, lat. 8 μ

Genus NEPHROCYTIUM Näg.

N. AGARDHIANUM var. ALLANTOIDEUM (Bohlin) Chodat.

Cœnobium interdum cellulis 8 geminatis dispositis.

Cœn. 4-cell. diam. circ. 25; 8-cell. long. 36, lat. 28 μ.

Cell. long. 10-14, lat. 2-3 μ.

Cf. Bohlin, Erst. Regnellsch. Exp., T. i., f. 21-22. Bernard, Protococc. et Desm., Pl. xii., f.390. Nägeli, Gatt. Einz. Alg., T. iii., fig.C n.

All the forms of *Nephrocytium* belong to the one species, *N. Agardhianum* Näg.

Var. LUNATUM(West) Chod.

Forma cellulis paullo crassioribus.

Cell. long. 18-21, lat. 7-8 μ.

Genus TETRAEDRON Kütz.

TETR. LOBULATUM var. SYDNEYENSE(Playf.).

Syn., *Staurophanum cruciatum β elegans* f. *Sydneyensis*, *antea* 1907, Pl. v., f.30.

Var. DECUSSATUM(Reinsch) mihi, forma. (Pl. lvi., f.10).

Forma corpore profunde inciso cruciforme; brachiis angustis lateribus pæne parallelis, processibus plus minus frondescentibus instructis.

In this form, the two opposite arms are bent upwards, and the other two downwards; indicating the transition in growth from the flat shape to the tetrahedral. I have noted the same in *Tetr. minimum*. Reinsch's *Polyedrium decussatum*, Mittelfr , T.ii., f.iii.; *P. gracile*, *l.c.*, T.vii., f.1; *P. enorme*, *l.c.*, T.vii., f.2; Turner's *Staurophanum cruciatum*, Alg. E. Ind., T.xx., f.20-21; and *St. pusillum* Turn., *l.c.*, T.xx., f.22; and *Dichotomum elegans* W. & G. S. West, N. Amer. Desm., Pl.16, f.33, are all forms of *Tetr. lobulatum*(Näg.) Hansg. So also is *P. enorme* Ralfs, Br. Desm., T.xxxiii., f.11, and indeed all the specimens of *Tetraëdron* with hyaline processes.

Var. TRIANGULARE, n.var. (Pl. lvi., f.11).

Forma tetraëdrica ab omni latere visa triangularis, angulis bifidis in processus glabros binos productis.

Diam. c. proc. 32; corp. 14 μ.

In the figure, the fourth lobe is distorted in order to mark its position plainly. The form is regularly tetraëdrical.

Genus Dactylococcopsis Hansgirg.

D. montana W. & G. S. West.

Long. cell. 8-15; lat. 2-3 μ.

D. raphidioides Hansg.

Cœn. long. 55-77; lat. 7-11 μ.

Cell. long. 14-32; lat. $2\frac{1}{2}$-3 μ.

I am decidedly of opinion that this is a degenerate form of *Spirotænia acuta* Hilse, which I have found at Fairfield in a pool, into which a scour from the Water-Supply drains. Cœn. 77 × 22, cells 40 × 10, bright green chloroplasts with a single pyrenoid. It is no objection that the endoplasm is homogeneous in *D. raphidioides*, as this is the case in most young and degenerate forms of unicellular algæ. *Spiro. tenerrima* Arch., is probably an intermediate form, *vide* W. & G. S. West, Monog. Br. Desm., Pl. iii., f.16-17.

Genus Chætosphæridium Klebahn.

Ch. globosum (Nord.) Klebahn.

Cell. diam. 12, probos. long. 8 μ. On *Spirogyra* filaments.

Var. microscopicum, n.var. (Plate lvi., fig.12).

Forma minutissima, cellulis sphæricis setis singulis longissimis instructis, endochroma homogenea.

Cell. diam. circ. 1 μ. On *Oedogonium* and *Melosira*.

This is probably the very smallest size of *Ch. globosum*, the outgrowth of a micro-zoospore.

Subfamily Phythelieæ.

Forms of *Lagerheimia* and *Chodatella* were present in almost all the samples from the filter-screens, being most abundant in June (winter). At first, an attempt was made to distinguish between the two genera (in spite of the fact that in no single instance were there any basal tubercles to the setæ) under the impression that the setæ in *Chodatella* were, at least, less robust than those of *Lagerheimia*. This theory, however, proved untenable, it being found that the setæ of *Chodatella subsalsa* and *Ch. longiseta* were often, especially in the former, quite as robust as those of *Lag. Genevensis*. Compare also Chodat's figure of *Ch. longiseta* in Algues vertes de la Suisse, p.192, f.35, and *Ch. citriformis* Snow (a variant) in Plankt. Alg. of L. Erie, Pl. ii., f.1-3. When, finally, the characteristic whorl of *Ch. longiseta* and the three setæ of *Ch. subsalsa* appeared at either end of the cell (Pl. liii., f.28), and likewise a combination of the three of *Ch. subsalsa* with the two of *L. Genevensis* (Pl. liii., f.27), it became evident that I was dealing with diverse variations of a single species. The presence of forms (especially var. *gracilis* mihi) agreeing exactly in size and shape with Chodat's types, made it quite clear that that species was *Lagerheimia Genevensis* Chod. *Vide* also the notes, *infra*, under the various forms. The genus *Chodatella* cannot stand; the basal tubercles of the setæ in *Lagerheimia*, which form the only distinction between the two genera, are very often wanting, and even when present, they are not permanent, but become confluent with the setæ as the latter develop. Out of a considerable number of cells examined, they were present in one individual only.

Genus LAGERHEIMIA Chodat, emend.*

Cellulæ . . . . . . *globosæ*, ellipsoideæ vel cylindraceæ, apice utroque rotundatæ *vel acuminatæ;* membrana firma in utroque fine setis 2-pluribus longis *plus minus* arcuatis, *basi vulgo* subcrassis (*rarissime* in tuberculis sedentibus) donatæ. *Cellula matricalis inter setas nonnunquam papilla instructa.* [Omit:—"Inter setas invenitur globulus hyalinus."] . . . . . corpusculum amyliferum 2-6 gerens . . . . . . Setæ autosporarum *interdum* intra cellulam maternam evolutæ. My additions are in italics.

LAGERHEIMIA CILIATA (Lagerh.) Chodat. (Plate liii., fig.1).

Cell. long. 10-15, lat. 7-12, setæ long. ad 30 μ. Cellulæ ovales.

The type; synonym, *Chodatella longiseta* Lemm., in Hedwigia, 1898.

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* From Lemmermann's diagnosis in Hedwigia, 1898, p.308.

In our forms, the setæ are often very tenuous, and sometimes quite weak and crinkled. They are rarely straight, being generally curved either outwards or downwards. The cells of this species exhibit three distinct shapes, viz., the oblong form of *L. genevensis*, the pointed shape of our common Australian var. *acuminata*, and the oval figure of the type. The same three type-forms are found occurring also in the variations with only two polar setæ. A very common size here, 12 × 8 or 12 × 9, is that given by Lemmermann for *Chod. longiseta*, and accords with the smallest dimensions in Lagerh., Pedi. Protococc. o. Palm., p.76, for *Oocystis ciliata*. The only difference between these two is the greater length of the setæ in Lemmermann's form.

Var. CORONATA, n.var. (Plate liii., fig.3).

Cellula oblonga vel ovalis, utraque parte rotundata; setis 5-8 ascendentibus, late patentibus, saepe debilibus fluctuosis.

Var. INFLATA, n.var. (Plate liii., fig.4-5).

Cellula lateribus arcuatis, ad apices rapide convergentibus; apicibus plus minus acuminatis; setis 5-8 vulgo late-patentibus.

Var. AMPHITRICHA(Lagerh.). (Pl.liii., f.6).

Cell. long. 9; lat. 8; setæ 12 μ.

Cf. Lagerheim, Sveriges Algflora, T.i., f.25, 26.

Var. GENEVENSIS(Chod.). (Pl. liii., f.7).

Cellula matricalis interdum late-elliptica, utroque polo papilla instructa; aplanosporis sæpe binis.

Cell. matric. long. 14-18; lat. 10-15; setæ ad 30 μ.

Aplan. long. 7-8; lat. 4 μ.

It is important to note that the mother-cells found in the plankton were often identical in size and shape with *Chod. citriformis* Snow, but possessing the two polar setæ of *L. genevensis* Chod. All these "species" of *Lagerheimia* and *Chodatella* are olymorphic forms of one true species.

Var. INERMIS, n.var. (Pl. liii., f.8, 9).

Formæ typicæ consimilis (vel ovalis) sed major, setis nullis.

Cell. long. 12-16; lat. 7-10 μ.

Numbers of this form were observed free. They are not newly formed aplanospores, but well-grown specimens, on which the setæ have not yet developed. This is evident from the fact that, in dimensions, they tally exactly with the verticillate forms. It is probably the greater strength of the cell that causes the larger number of setæ, the smaller cells of every shape generally possessing only two or at most three at each pole. In no case have I observed aplanospores furnished with even rudimentary setæ while within the mother-cell; probably the higher temperature of our waters brings about the early solution of the containing membrane.

Var. GRACILIS mihi(*L. genevensis* Chod., *pro parte*, l.c., f.2).

Forma gracilior, elliptica, setis sæpe minime divergentibus.

Cell. matric. long. 14-15, lat. 10-11 μ.

Cell. long. 8-10, lat. 3-3½, setæ ad 20 μ. (Pl. liii., f.10 12).

A very distinct form. A forma *decussata* mihi was noted, with the pairs of setæ decussating. In this variety, the setæ are generally quite straight, and so widely divergent often as to be almost parallel.

Var. SUBGLOBOSA(Lemm.).

Cell. long. 8; lat. 7 μ.

Only one specimen was observed free, but, in cells with four aplanospores, the latter appertain in shape indiscriminately to var. *subglobosa* and var. *acuminata*. No tubercles at the base of the setæ.

Var. ACUMINATA, n.var. (Pl. liii., f.13-19).

Aplanosporis ellipticis utroque polo acuminatis; lateribus arcuatis ad apices rapide convergentibus; pyrenoidibus minutis binis

Cell. matric. long. 14-22; lat. 14-18½ μ.

Aplan. long. 7-14; lat. 4-10; setæ ad 33 μ.

Var. *acuminata* is a very distinct shape, but, at the same time, it is only an alternative form of the type. The same twin-forms occur also in *Oocystis solitaria*, *Eremosphæra viridis*, and in a marine diatom (unidentified) lately obtained from Ryde, the two forms in the same gathering. Var. *acuminata* is the shape generally found in small cells with only two or three setæ, and is the commonest form for aplanospores in the plankton. A single cell was noted with the setæ just commencing as minute tubercles (Pl. liii., f.18). Also a f. *decussata* mihi was observed with two pairs of setæ arranged decussately. The mother-cells, when fully developed, are spherical, either with or without an apiculus; occasionally one is found depressed vertically.

Var. SUBSALSA(Lemm.) mihi, forma.

Forma var. *acuminatæ* consimilis, ternis autem setis utroque polo instructa. Cellula matricalis (matura) globosa, interdum utroque polo levissime acuminata vel apiculo minuto instructa.

Cell. matric. long. 16-18; lat. 14-18; setæ ad 30 μ.

Aplan. long. 8-10; lat. 6-7; setæ ad 22 μ.

This is the Australian form of *Ch. subsalsa* Lemm., Forsch, biol. Stat. Plön., vi., T.5, f.2-6. Cf. also G. S. West, Third Tanganyika Exp., Pl.5, f.14-17.

Forma mixta 1, var. *subsalsa*(Lemm.) + var. *acuminata* mihi.

Cell. matric. long. 12; lat. 14; setæ ad 20 μ.

Aplan. long. 8-10; lat. 7; setæ ad 30 μ. (Pl. liii., f.27).

Forma mixta 2, var. *subsalsa*(Lemm.) + *L. ciliata*(type).

Cell. long. 7-10; lat. 6-8 μ. (Pl. liii., f.28).

Var. GLOBOSA n.var. (Pl. liii., f.20).

Cellula matricalis elliptica, utroque polo acuminata; setis binis ad polos instructa. Aplanosporis globosis.

Cell. matric. long. 11; lat. 8; setæ long. 27 μ.

Aplan. diam. 5-6; setæ 20 μ.

The mother-cell with two globose aplanospores was found in exceedingly shallow water at Gardener's Road, Botany. A globose cell with setæ was noted in the plankton. It is only an accidental formation occurring in a very young cell. In this case, the mother-cell only measured 10 × 8, whereas aplanospores within the matrix often measure 10 × 6. Cells need not be full grown before aplanospores can be developed. Their formation is due more to external circumstances (probably temperature) than to any maturity of the cell. In half-grown cells(Pl. liii., figs.29, 30, 34, 37) generally only two aplanospores are produced, with considerable variation in the shape. With the form from Botany, Pl. liii., f.37, compare Pl. liii., f.34, in which may be seen the same form (var. *acuminata*) with two aplanospores, 7 × 4, having the oblong shape of *L. genevensis*.

Var. CRISTATA, n.var. (Pl. liii., f.21).

Cellula globosa, utroque polo setis 5-8 deorsum curvatis, assurgentibus instructa. Cell. diam. 12 μ.

Var. STRIOLATA, n.var. (Pl. liii., f.22-25).

Cellulæ oblongæ vel ovales, transverse striolatæ vel costatæ (striis 9-11 vel costis 6); setis 5-8 debilibus late-patentibus instructæ.

Cell. long. 11-18; lat. 7-9 μ.

Var. COMOSA, n.var. (Pl. liii., f.26).

Cellula ovalis; filis pituitosis longissimis 5-8, utroque polo ornata.

Cell. long. 6; lat. 5; fil. long. circ. 80 μ.

Genus GOLENKINIA Chodat.

GOL. RADIATA Chodat.

Diam. cell. 14; long. set. 24 μ.

Not noted in the Sydney Water-Supply, but found in a plankton gathering from the Parramatta River (fresh).

Var. PAUCISPINA(W. & G. S. West) mihi. (Pl. liii., f.39).

Diam. cell. 20; long. set. 3-12 μ.

Var. AUSTRALIS, n.var. (Pl. liii., f.40).

Cellulæ globosæ; setis brevibus sparsis, primo rectis, postremo bifidis.

Diam. cell. 18; long. set. 7 μ.

I do not consider that there is anything specifically characteristic in the length or number of the setæ in *Golenkinia*. Compare *Lagerheimia ciliata* var. *comosa* with the type.

Subfam. DESMIDIACEÆ.

Genus DOCIDIUM Ralfs.

DOC. TRABECULA var. DELPONTEI f. CONSTRICTA Playf., *antea* 1910. (Pl. liv., f.1).

Forma apicibus perfecte rectangularibus, minute granulatis; granulis circ. 12 (visis 7). Suture prosiliente.

Long. 600-694; lat. bas. infl. 30-34; constr. 26-28; centr. 28-32; ap. 21-23 μ.

The apex in these specimens was sharply rectangular. This was due to the presence of about twelve minute granules at the extreme tip, which were just large enough to square off the otherwise rounded angles. This makes the sixth form of apex noted for *D. trabecula* var. *Delpontei.*

Genus SPIROTÆNIA Bréb.

SPIRO. MINUTA Thuret. (Pl. liv., f.2).

Long. 18; lat. 4-5 μ.

Frequent in the filter-samples in April, not observed again.

SPIRO. BISPIRALIS var. FUSIFORMIS, n.var, (Pl. liv., f.3).

Forma minor, cellulis fusiformibus; apicibus brevissime expansis, truncatis, incrassatis. Endochroma in tænias 2 decussatim ordinata, tæniis circuitus 2-3 efficientibus.

Long. cell. 53; lat. 8 μ.

Genus GONATOZYGON De By.

GON. KINAHANI (Arch.) Rab.

Long. 155-630; lat. 11-14 μ.

Var. MONOTÆNIUM(De By.) mihi,(Syn. *G. Ralfsii* De By.).

Long. 82-206; lat. 7-8 μ.

Var. KJELLMANNI(Wille) mihi,(Syn. *G. Kjellmanni* Wille).

Long. 101-148; lat. 12 μ.

Fifteen cells forming a single chain. It is a form of *Gon. Kinahani* var. *Ralfsii* in which the cells have been greatly shortened by repeated division. (Pl. liv., f.4).

Var. TENUISSIMUM, n var. (Pl. liv., f.5).

Forma minuta, angustissima; lateribus parallelis; apicibus truncatis nec incrassatis; cellulis sæpe in filamentis consociatis. Membrana lævis, glabra. Endochroma homogenea in baculo unico (ut videtur) ordinata, in extremis sæpe granulis singulis instructa. Pyrenoidibus nullis.

Long. 54-112; lat. $1\frac{1}{4}$-$2\frac{1}{2}$ μ.

Present in all the filter-samples, frequent in June.

All the forms of *Gonatozygon* belong to a single species, the nomenclatural type being *Gon. Kinahani*, since *Doc. asperum* Ralfs, contains two different forms. The three principal forms are quite common round Sydney, and are always found in the same water. Compare W. & G. S. West, Monog. Brit. Desm., Pl. i., figs.1 and 5, with Pl. ii., figs.1 and 3, the outlines are exactly the same in each case. I have shown (*antea* 1910), in connection with the forms of *Docidium*, that no specific distinction can be deduced from the character of the membrane, even granulate and smooth being found in the same cell. Polym. & Life-Hist., Pl. xi., f.3, and Pl. xiv., f.11.

Genus PENIUM Bréb.

P. POLYMORPHUM var. CYLINDRACEUM, n.var. (Pl. liv., f.6).

Forma angustior cylindracea; lateribus parallelis; apicibus laterotundatis.

Long. 34-36; lat. 14 μ.

Var. MOOREANUM (Arch.) mihi. (Pl. liv., f.7, 8).

Long. 18-24; lat. 10-12 μ.

Suture sometimes evident, sometimes not. The shape varies, with growth, from a regular ellipse to the form of the type. Syn. *P. Mooreanum* Arch.

Var. MINUTISSIMUM (Nord.) mihi. (Pl. liv., f.9, 10).

Long. 13-16; lat. 8-9 μ.

Syn. *P. minutissimum* Nord., Norges Fersk. T.i., f.21.

Var. TURNERI, mihi. (Pl. liv., f.11).

Long. 9-12; lat. 5-7 μ.

Syn., *Cylindrocystis minutissima* Turn., Alg. E. Ind., Pl.i., f.24. In some specimens, the suture was evident.

P. polymorphum Perty, is very common round Sydney, and there is not the slightest doubt that the three foregoing are growing forms of it. They are all frequent in the filter-samples, and associated also in Sydney gatherings. Cf. also Schmidle, Alg. Schwarz. u.d. Rheinbene, p.21, T.iii., f.8-11.

Genus COSMARIUM Corda.

COS. CAPITULUM var. DETRITUM, n.var. (Pl. liv., f.12).

Forma apicibus lateribusque perfecte levigatis, angulis superioribus non productis.

Long. 16; lat. 20 μ.

COS. CONTRACTUM var. ELLIPSOIDEUM f. INTERMEDIA, n.f.

Forma var. *ellipsoideo* consimilis sed circa dimidio minor.

Long. 20-30, lat. 15-24; isth. 3-5 μ.

F. MINOR Rac.

Long. 12-18; lat. 9-14; isth. 3-4 μ.

The size of *Cos. contractum* var. *ellipsoideum* is 48-51 × 38-42. All sizes occasionally have an incrassate spot in the centre of the semicell, a characteristic which they owe to their being young forms of *Xan. hastiferum*, etc. Connected with them in the same life-history, are *Cos. subtumidum* Nord., *Cos. phaseolus γ achondrum* Boldt, and *Cos. foveatum* Schm.

Cos. ellipsoideum, type, is the same as *Cos. incrassatum* Playf., *antea*, 1907, Pl. v., f.15, but without the incrassate spot.

Var. SUBFOVEATUM, n.var. (Pl. liv., f.13).

Semicellulæ subreniformes, apicibus levissime truncatis; sinu extrorsum aperto; angulis lateralibus latissime-rotundatis; lateribus arcuatis ad apices convergentibus. Membrana punctata, tractu incrassato vel macula infra apices instructa. Pyrenoidibus singulis.

Long. 33-46; lat. 26-38; isth. 6 μ.

In size and shape very like *Cos. subtumidum* Nord., for which see W. & G. S. West, Monog. Br. Desm., ii., Pl. 63, f.18-20.

Var. SUBELLIPTICUM, n.var. (Pl. liv., f.14).

Semicellulæ subellipticæ vel subtriangulares, ad apices levissime acuminatæ, superne valde arcuatæ, inferne basi convexa; lateribus utraque parte curvatis; angulis lateralibus latissime-rotundatis; membrana tractu incrassata infra apices instructa.

Long. 40; lat. 33; isth. 6 μ. Cum priori.

COS. ANISOCHONDRUM var. CONFUSUM, n.var. (Pl. liv., f.15).

Semicellulæ subtriangulares; apicibus angustis truncatis; angulis lateralibus latissime-rotundatis; lateribus sursum levissime arcuatis ad apices convergentibus; puncta-granulis in seriebus radiantibus, granulis 2-3 infra marginem, ad isthmum granulis 4, media semicellula paucis obscuris irregulariter dispositis ornatæ.

Long. 28-30; lat. 27-30; isth. 7; ap. 12 μ.

COS. MENEGHINII var. REGNELLII (Wille) mihi, formæ. (Pl. liv., f.16).

Una semicellula formæ typicæ consimilis sed apice crenis obscuris 4 instructa; altera lateribus arcuatis ad apicem truncatum convergentibus, lateribus crenis 3 ornatis, apice crenis obscuris 4.

Long. 17; lat. 15; isth. 4; ap. 8 μ.

Syn., *Cos. Regnellii* Wille, Sydamer. T. i., f.34. These forms show *Cos. Regnellii* passing over into *Cos. Meneghinii.* Two intermediate crenæ form on the apex, and one on each side at the base; with growth of the semicells, the crenation gradually becomes regular.

COS. TURGIDUM var. ALPESTRE (Roy & Bisset) mihi.

Endochroma in tænias parietales 8 ordinata.

Long. 75-86; lat. 68-80 μ.

Syn., *C. alpestre* Roy & Bisset, Scottish Desm., p.29, Pl. i., f.6. The specimen was surrounded by a mucous investment

152 μ in diameter. This mucous investment is a sure sign that the cell has been under conditions of partial dessication; it is not the sign of a sporangial form. *C. alpestre* is a form of *C. turgidum* produced by repeated mitosis. Cf. also *C. turgidum* var. *subrotundatum* West, in W. & G. S. West, Monog. iii., Pl.75, f.4. *C. subturgidum*(Turn.) Schm., *l.c.*, Pl. 74, f.22-23, is also a form of *C. turgidum.*

Cos. BINUM var. FONTENSE (Playf.). (Pl. liv., f.17).

Semicellulæ longitudine latiores, levissime truncatæ; crenis circa 20, sæpe emarginatis. Infra marginem granulis geminatis in seriebus 3 et granulis singulis in serie unica ordinatis ornatæ. Ad isthmum tumore granulis magnis 5 et supra jugis verticalibus 5 instructo. Circa tumorem area nuda.

Long. 56-64; lat. 45-50; crass. 30-34; isth. 15; apex 15 μ. No.22.

Syn., *Cos. subspeciosum β validius* forma *fontensis* Playf. (*antea* 1907, p.198). As the tumor seems to be characteristic of *Cos. binum* Nord., I have arranged the above under that form. In the shape of the semicells, however, it agrees with *Cos. subspeciosum β validius* Nord. It is very near to *Cos. binum* var. *australiensis* Borge, Austral. Süsswasserchlor, T.iii., f.42.

Genus STAURASTRUM Meyen.

ST. CONNATUM var. MUTICUM, n.var. (Pl. liv., f.18).

Forma var. *Spenceriano* consimilis sed sine spinis.

Long. 20; lat. 18-21; isth. 4 μ.

The same form, with short spines, was common in most of the samples.

ST. MARGARITACEUM var. CRUCIATUM, n.var. (Pl. liv., f.19).

Semicellulæ a fronte campanulatæ, parte superiore in processus producta; apicibus levigatis, leniter arcuatis; basis granulorum minutorum seriebus singulis ornatis. A vertice 4-radiatæ, processibus latis cuneatis, granulorum seriebus ternis transversis ornatis; apicibus 4-fidis granulatis, nonnunquam (seriei intimæ etiam granulis) minute denticulatis; ad angulos inter processus granulis 4 per quadrata disositis.

Long. centr. 28; lat. c. proc. 34; lat. corp. 15 μ.

St. paradoxum var. cingulum W. & G. S. West, Scott. Plankt., Pl.18, f.7.

Long. c. proc. 84; s. proc. 54; lat. c. proc. 104; s. proc. 17 μ.

Var. perornatum, n.var. (Pl. liv., f.20).

Forma semicellulis infra processus valde constrictis; basibus subglobosis; apicibus truncatis leviter productis; processibus minime divergentibus, 8-undulatis, undulationibus a fronte visis superne et inferne alternantibus, verrucis minutis, oblongis, truncatis, singulis, superne 5 inferne 6 instructis; supra isthmum granulis 6 (visis). A vertice processibus 8-undulatis sine verrucis.

Long. s. proc. 48; lat. c. proc. 92, s. proc. 15 μ.

St. pseudosebaldi var. coralloideum (Playf.), forma. (Pl. liv., f.21).

Forma bi-radiata. Semicellulæ ad apices in medio verrucis bigranulatis 6, utrinque verrucis truncatis 3, in extremis radiis spinis 5 instructæ. Inferne verrucis bifidis 4 et spinis 5. Fronte in medio granulis geminatis 6 verticaliter dispositis, utrinque granulis singulis 8, majoribus 3 minoribus 5 (spinis a vertice visis) preditæ. Processus apicibus 4-fidis spinis bacillaribus.

Long. 40; lat. c. proc. 70; lat. bas. 15; isth. 8 μ.

I consider that my *St. coralloideum* (*antea*, 1907, p.187) is a form of *St. pseudosebaldi* Wille.

St. volans var. elegans Playf. (Pl. liv., f.23).

Long. centr. 24; lat. c. proc. 53; lat. corp. infra proc. 10; supra isth. 6; crass. 11; isth. 3 μ.

Var. trigonum, n.var. (Pl. liv., f.24).

A vertice semicellulæ triangulares, angulis in radios longos angustissimos apicibus trifidis productis; ad bases processuum interdum spinis singulis, interdum verrucis simplicibus aut bifidis utrinque instructæ; centro serie granulorum 6 concentrice disposita ornatæ.

Long. c. proc. 27, s. proc. 15; lat. c. proc. 50 isth. 6 μ.

St. ORBICULARE var. MUTICUM(Ralfs) mihi.

Forma mixta: – type + var. *muticum.*

Long. 38; lat. 32; isth. 14 μ.

St. muticum is only a growth-form of *St. orbiculare*; mixed forms are quite common.

Var. PROTRACTUM, n.var. (Pl. liv., f.25).

Semicellulæ semi-ellipticæ, subtriangulares, interdum adpressæ; basi planæ; angulis lateralibus late-rotundatis; lateribus leniter arcuatis; apicibus levissime acuminatis.

Long. 43-48; lat. 47 μ.

This form was first found at Collector. In the plankton, it was noted as a mixed form with the type, both, however, with incipient processes. Cf. Ralfs, Br. Desm., T.xxi., f.5h; and Roy & Bisset, Jap. Desm., f.14, of which it is a forma major.

Var. PLANKTONICUM, n.var. (Pl. liv., f.27).

Forma minuta sinu aperto valde constricta; semicellulæ semi-ellipticæ, angulis inferioribus paullulo quadratis; lateribus e basi plus minus rectis; apicibus leniter arcuatis. A vertice triangulares; lateribus valde retusis; angulis paullo quadratis, lateribus parallelis, apicibus subtruncatis rotundatis.

Long. 20; lat. 15; isth. 7 μ. Common.

Cf. Schmidle, Schwarz. u. Oberrh., Fig. iv., 1.

MYXOPHYCEÆ.

Genus SCYTONEMA Ag.

SCYT. MIRABILE(Dillw.) Bornet, Bull. Soc. Bot. Fr. xxxvi., 1889.

Lat. fil. 18-20; lat. trich. 6-8; heterocyst. long. 14-16, lat. 10-12; cell. veg. alt. 4-12 μ.

Syn., *Scytonema figuratum* Ag. (Pl. lvi., f.13*a*,*b*,*c*).

Var. AMPLUM(West) mihi. (Pl. lvi., f.13*c*).

Lat. fil. 18-20; lat. trich. 4; cell. veg. alt. 12-20 μ.

Syn., *Scy. amplum* West, Frw. Alg. W. Ind., p. 270, Pl. xvi., f.14-16.

Var. AMBIGUUM(Kütz.) mihi. (Pl. lvi., f.13*d*).

Lat. fil. 18-20; lat. max. trich. 4; cell. veg. alt. 12-20 μ.

Syn., *Scy. ambiguum* Kütz., *Fischerella ambigua* Gomont.

These forms, besides being noted separately, were all found succeeding one another in the same filament within $\frac{1}{2}$mm., as figured.

Genus CALOTHRIX Ag.

(?)CALOTHRIX CONVERVICOLA(Roth) Ag. (Pl.lvi., f.14-16).

Diam. fil. 13-18; diam. trich. 12-13; cell. alt. 3-6; hormog. alt. 12-16 μ.

The characters are nearest to *C. confervicola*, but that is a salt-water form.

Genus OSCILLATORIA Vaucher.

O. NIGROVIRIDIS Thwaites, forma CRASSIOR, n.f.

Lat. trich. 12-15; alt. cell. 2-8 μ.

Very common in the filter-samples. The margin, generally crenulate, is occasionally quite smooth. The name is rather misleading (if my identification is correct, cf. Askenasy in Bailey's Bot. Bull. xi., p.50); the colour varies a good deal. The tints observed in the trichomes of fresh specimens were grey-blue, dull purple-blue, pale blue-green, dull green, the last predominating. It is curious to find this species in the Water-supply, and in various bodies of freshwater round Sydney, as it is generally marine; and I have myself found it in saltwater swamps at Newington, and in the plankton of the Parramatta River (marine) Trichomes from the latter were 14 μ in diameter, cells 3 μ alt. and strong green in colour,

Var. AUSTRALIS, n.var. (Pl. lvi., f.17,18).

Latitudine duplo major.

Lat. trich. 25-27; alt. cell. 4-8 μ.

Pl. lvi., f.17, indicates the formation of the tip of the trichome from a broken filament. The cytoplasm contracts, and the exposed cell-wall sloughs away. Undoubtedly the calyptra, occasionally present, is of no specific value, being merely the result of the incrassation of the apical cell. Broken filaments show distinctly that, in *Oscillatoria*, the trichome consists of a definite membranous tube with true septa; the cells are not merely united together by mucus, as in *Anabæna*.

O. AMPHIBIA var. BIGRANULATA, n.var.

Septa cellularum utrinque granulo amylaceo instructa.

Lat. trich. 2; alt. cell. 6-8 μ.

BACILLARIEÆ.

Genus VANHEURCKIA Bréb.

V. RHOMBOIDES(Ehr.) Bréb., var. SAXONICA(Rabh.).

Long. 50-90; lat. 13-16 μ.

Var. NEGLECTA(Thw.) mihi.

Long. 50-70; lat. 8 μ.

Syn., *Schizonema neglecta* Thw., *Nav. gracilis* var. *neglecta*(Thw.) W. & G. S. West.

I think it certain that this diatom is simply a narrow form of *V. rhomboides*. They both abound in the waters round Sydney, and are nearly always found together. There are several forms of var. *neglecta*, of which two answer to *V. rhomboides* and its var. *saxonica* respectively. Considerable variation also exists in the character of the central line, and the central and apical nodules are sometimes entirely wanting. This central line is not a true raphe or slit in the membrane, but an incrassate columella on the inner side of the valve, and enclosing the central nodule. It is this lateral broadening that causes the central nodule in most *Vanheurckia* forms, to appear excavated at each side.

Var. HITCHCOCKII(Ehr.) mihi, forma.

Forma utrinque in medio quam levissime inflata, apicibus obtusioribus, paullo magis productis.

Long. 56-75; lat. 14-16 μ.

Syn., *Nav. Hitchcockii* Ehr., cf. Donkin, Br. Diats., Pl. v., f.4, whose figure works out at long. 70 μ. Closely connected is *N. incurva* Greg.,(Donkin, *l.c.*, Pl. vi., f.2, and O'Meara, Irish Diats., Pl.31, f.56) All the Crassinerves-group of the genus *Navicula* should be united with *Vanheurckia*, the incrassate columella (whether simple or divided) being characteristic; and I am decidedly of opinion that they are all immature forms of *Stauroneis*. Here they are always found in company with varieties of that genus.

Genus Stenopterobia Bréb.

Sten. anceps(Lewis) Bréb. (Pl. lvi., f.19).

Long. 133-168; lat. 8-9 μ.

Not *Sten. anceps* Heribaud, Diats. d'Auvergne, Pl. v., f.4. The form given by Lewis, Proc. Acad. Nat. Sci. Philad. 1864, is identical with *Nitzschia franconica* Reinsch, Mittelfr., Pl.i., f.1*a*, but lacks the alæ in side-view. The dimensions of our specimens tally exactly with those of Reinsch.

Var. intermedia(Lewis) mihi. (Pl. lvi., f.20).

Long. 250; lat. centr. 10, subsp. 8; crass. 12 μ.

This is, as far as my observations go, the full-grown form of the species. It narrows gradually from the centre to the ends, which are slightly dilated. I have not noted this form in the Sydney Water-Supply, but have obtained the frustules in quantity, *alive*, from the swamps at Gardener's Road, Botany. It has always been considered a fossil species.

National Herbarium samples 108, 131, 142, 155.

Var. Heribaudii mihi. (Pl. lvi., f.21, 22).

Long. 80-134; lat. 6-8 μ.

Syn., *Stenopterobia anceps* Heribaud, *l.c.*, Pl. v., f.4, non Lewis. Quite distinct in appearance from Lewis' form, into which it develops. O. Müller, in Bacillariales aus den Hochseen des Riesengebirges, T.iii., f.35-37, gives illustrations of the structure. Cf. also Gutwinski, De Algis in insula Java collectis, Pl. xl., f.66.

Var. DETRITA, n.var. (Pl. lvi., f.23).

Frustula angusta, linearis, leviter sigmoidea; lateribus parallelis; apicibus rotundatis.

Long. 40-60; lat. 5 μ.

This form develops into the slender form of var. *Heribaudii*, f.21, by growth at the apices, the frustule thus becoming more sigmoid, and the apices produced and pointed. They both are very common in the waters round Sydney, being always found associated together, with the type more sparsely intermixed.

Genus MELOSIRA Ag.

MELOSIRA GRANULATA (Ehr.) Ralfs.

Diam. fil. 3½, 4, 6, 8, 10, 12, 15, 20; cell. alt. 30, 34, 25, 20-27, 25, 20, 20-24, 16-20 μ.

In prodigious quantities, absolutely swamping everything else. The filaments of diam. 20 μ (relatively few) had granules very distinct, arranged squarely in 13 longitudinal and 7 transverse rows. Some filaments were observed deeply rufescent, and, in a few, the cytoplasm, instead of being yellowish, was of a bright strong green colour.

Var. CIRCINALIS, n.var.

The filaments curved into a perfect circle, or arc of a circle.

Genus CYCLOTELLA Kütz.

CYCL. MENEGHINIANA Kütz.

Diam. 10, 12, 14, 15, 16, 18, 20, 22 μ.

Var. MINUTISSIMA, n.var, (Pl. lvi., f.24).

Diam. 4, 5, 6, 8, 10 μ. No.90.

No markings or striæ whatever, save that, on the largest, a rosette of dots appears in the centre, representing the areolæ of var. *stelligera*. The striæ, however, will appear with growth. A good proof that these frustules are all in a state of growth, is found, it seems to me, in the fact that it is quite easy to obtain an ascending series of sizes connecting the smallest with the largest, the successive terms of which differ from one another by no more than 1 μ in diameter. It is appalling to have to believe that each size is a separate evolutionary variation of the type, absolutely unconnected in growth and development with even the size next above it.

Var. MAJOR, n.var. (Pl. lvi., f.25).

Diam. 32 μ. Undulate in side-view. The specimen is figured with the chromoplasts *in situ*.

Var. STELLIGERA Cleve et Grun., forma. (Pl. lvi., f.26).

Frustula in medio areolis cuneatis radiantibus 6-10 ornatæ.

Diam. as in the type. Cf. P. T. Cleve, New and little known Diatoms, Pl. v., f.63c.

There is an error in the description of plates; it should read:—"c. from France; b. var. *stellulifera* Grun.," instead of *vice versa*, see p.22. Note also Schröter, Schwebeflora unserer Seen, f.54, but the form is undoubtedly a variation of *Cycl. Meneghiniana*.

Var. KUETZINGIANA(Thw.). (Pl. lvi., f.27).

Diam. 12; crass. 8 μ.

Cf. Thwaites, Ann. Nat. Hist., Ser.2, 1848, Pl.xi., f.D1, 2. This form was found in quantity in a duckpond in the Botanic Gardens, fed from the Sydney Water-Supply. It is var. *minutissima* with the marginal striæ beginning to form. They begin to form as mere points round the inner edge, and gradually extend inwards. In f.27, the striæ have been wrongly drawn; they should be short wedge-shaped dashes. Thwaites, fig.5, *loc. cit.*, is my var. *major*, but diam. 40 μ.

SCHROETER'S FORM. (Pl. lvi., f.28).

Occasionally two or four *Cyclotella* frustules might be seen embedded in a cylinder of mucus, with pores radiating out on all sides. Cf. *Cycl. comta* var. *quadrijuncta* Schröter, *l.c.*, f.58. Such, however, are merely caused by repeated mitosis under conditions of partial dessication. Schröter's form has been accorded the rank of a species as *Cycl. Schröteri;* the form, however, is common to all species of *Cyclotella.*

Genus Rhizosolenia (Ehr.) Brightwell.

Rhiz. eriensis var. morsa W. & G. S. West.

(Pl. lvi., f.29-31).

Long. corp. 29-140; lat. 7-14; crass. $2\frac{1}{2}$-4; long. sp. 18-32μ.

Cf. W. & G. S. West, Trans. R. Soc. Edin. xli., pt. iii., 1905. Our frustules are somewhat smaller than European specimens, and the spines very much shorter. Cf. Peragallo, Monog. Rhiz., Pl. i., f.19, and W. & G. S. West, Plankt. of some Irish Lakes, Pl. xi., f.5-7. All the freshwater *Rhizosolenia* form one species.

Var. Zachariasi (Brun) mihi.

Imperfect forms from the plankton. (Pl. lvi., f.33-35).

Long. corp. 42-64; lat. 14-16; long. sp. 18-28; lat. ann. 2 μ.

Perfect forms from Brisbane. (Pl. lvi., f.36-38).

Long. corp. 22-48; lat. 11-15; long. sp. 10-18; lat ann. 2 μ.

Syn., *Attheya Zachariasi* Brun. Cf. Apstein, Süsswasser-plankton, p.143, f.36. That the Brisbane forms are smaller and with shorter spines is natural, owing to the higher temperature of the water there. Fig.33 should have a narrow blank space down the centre; in this, the longitudinal septum forms later. A very interesting series of forms is here presented, illustrating the reduplication of *Rhizosolenia eriensis.* Fig.29 is the simple form; it has apparently two modes of reproducing itself. In the first, the frustule simply increases in breadth towards the side remote from the spines, the narrow blank space down the centre of such forms being probably the place where the new membrane is forming. The emarginate corners meanwhile grow outwards (fig.33), to fill in the rectangle; and two new spines develop at the apices. The other way of reduplication is exemplified in fig.32, which should be just a little more curved. It was quite evident, from the appearance of this frustule, that each pole had twisted round through an angle of 90°, so as to bring the spines into the position shown in figs.30, 31. The emarginate portions now grow outwards on either side, and two new spines complete the double frustule. Compare figs. 34, 35. The two frustules then break apart down the central septum. It is unfortunate that I was unable to find a perfect reduplicated form, var. *Zachariasi*, in the Sydney Plankton; figs. 36-38 reproduce three forms from Brisbane. Cf. Schröter, Schwebeflora, figs.31, and 31*b*.

This series affords indisputable proof of the growth of the siliceous membrane of diatoms.

Var. GRACILIS H. L. Smith. (Pl. lvi., fig.39).

Frustula angusta, apicibus conicis incrassatis, annulis imbricatis aut parallelis aut nullis.

Long. corp. 75-83; lat. 4-7; long. sp. 24 μ.

Rare among quantities of the other. It is probably a form produced by strong longitudinal growth, which opens out the annuli and causes them to assume an imbricate appearance. Specimens were noted without annuli, and, in the form figured, they were imbricate at one end and parallel at the other. Cf. Apstein, Süsswasserplankton, p.143, f.37; and Peragallo, Monog. Rhizosolenia, Pl. iv., f.17.

PERIDINIEÆ.

Genus CERATIUM Schrank.

CERATIUM HIRUNDINELLA O. F. Müller.

This species was abundant in all the samples throughout the year. In every case, the specimens were large and well-grown, with strongly reticulate membrane. No examples were found of the common European variation figured by Lemmermann in Plankt. Schwed. Gewass., T.2; and by W. & G. S. West in Frw. Plankt. Scottish Lochs, p.494, and in Plankt. Irish Lakes, p.94.

The following dimensions indicate in each case the range of five or six specimens:—

		April.	Aug.	Feb.
Long.	...	282-324	244-300	250-311
Lat.	...	—	50-62	53-63
Ap. horn	...	120-144	116-142	113-130
1st Ant.	...	90-108	80-112	80-107
2nd Ant.	...	66-78	64-80	75-80
3rd Ant.	...	12-30	16-50	30-42

In the case of the 3rd Ant. horn, at any rate, it was quite evident that the horns grow out from the body; every size could be observed, from almost nothing up to 50 μ.

Genus PERIDINIUM Ehr.

The filter-samples yielded abundance of *Peridinia* of all shapes and sizes, but although several types could be easily distinguished, there were many indications to show that they were all the various stages of growth and development of a single species. The slanting excavation at the back of the hypovalve is common to forms of every size, as is also the extremely broad vertical furrow with which it is connected, and the tooth on either side. The two smaller teeth close together, at the summit of the epivalve in the larger forms, are the direct outgrowths of the short,square, produced apex in the smaller ones. Again, a perfect series of sizes could easily be obtained from 20 μ to 80 μ in length. The following figures, which are merely the dimensions of those sketched for reproduction, sufficiently indicate this:—20 × 16, 24 × 18, 30 × 21, 30 × 27, 32 × 28, 34 × 24, 35 × 27, 38 × 35, 42 × 29, 44 × 38, 44 × 40, 50 × 46, all smooth membranes; 60 × 53, 63 × 57, 63 × 60, 63 × 63, 70 × 67,76 × 70, 76 × 76, all granular; while the fact that the ridged forms—44 × 42, 46 × 42, 46 × 44, 52 × 52, 54 × 54, 54 × 59, come in just at that point when the granulation is about to form on the hitherto smooth membrane, shows quite plainly that their incrassate ridging is due to some sudden influence at that critical period—stagnation, perhaps, or a sudden rise of temperature. Cells also were noted, in which it was quite clear that the ridges of the membrane are merely rows of granules coalesced and accentuated by incrassation (Pl. lv., f. 4*f*). Further, although most specimens present individual peculiarities and irregularities, such as might reasonably be expected in growing cells, the general disposition of the inter-tabular grooves or ridges (when present) is the same, front and back, for every type found in the plankton.

This arrangement of the inter-tabular grooves is the same as figured for *P. tabulatum* by Klebs, Organ. einig. Flagellaten-Gruppen, T.ii., f.28; and by Apstein, Süsswasserplankton, p.152, f.52, the figure in the latter being taken from Stein's Organismus, T.xi., f.11. It is, therefore, impossible to doubt that all the types observed in the plankton are stages of development in the life-history of a form which is merely a local variant of *P. tabulatum*. Corroborative of this, is the fact that cells were noted with the usual reticulate membrane of that type.

I consider it, however, as quite certain that *all* the various freshwater "species" of Peridinium are polymorphic forms of one true species. Schilling's diagrams in Süsswasser Peridineen, T.iii., figs.21-25, show that the arrangement of the plates in the hypovalve is the same for *P. tabulatum*, *P. cinctum*, *P. bipes*, *P. quadridens*, and *P. umbonatum* (compare also our Pl. lv., f.11), and the difference in their epivalves is very slight. More significant still is the fact that, although *Peridinium* propagates largely by micro-zoospores, only a single resting cell has been noted(Penard, Peridiniacées du Leman, Pl. iv., f.4), and this is connected (as is natural) with the most minute form of *Peridinium* known. The same resting cell, I have obtained from swampy ground in Auburn in some quantity, and, associated with it, transition-forms showing plainly its development into a *Peridinium*—a local variant of *P. inconspicuum* Lemm. Were the various "species" really distinct, there would be a distinct resting cell and life-history for each; but as it is, when any local "species" is investigated thoroughly, a series of forms is brought to light always leading down to *P. pusillum* Penard, or to one of its variants such as

P. Orrei Huitfeldt-Kaas, or *P. inconspicuum* Lemm. If these intermediate forms are not noted, it is only because a sufficient quantity of material has not been obtainable.

PERID. TABULATUM(Ehr.). (Pl. lvii., figs.1-3).

Long. 42-44; lat. 42 μ. No.115.

Two specimens were noted, globose, with typical areolate membrane. The disposition of the plates in the hypovalve was almost exactly the same as in our var. *granulosum*; while their arrangement in the epivalve was strikingly like that in var. *Westii*. Compare Pl. lvii., f.2, with Pl. lv., f.2*a* and 4*c*; and Pl. lvii., f.3, with Pl. lv., f 6. The disposition of the vertical and transverse furrows, on the reverse, answered perfectly to that in Pl. lv., f.5*b*.

Var. GRANULOSUM, n.var. (Pl. lv., figs.1-4).

P. globosum vel ovatum, ut in forma typica, tam longum quam latum vel paullo longius, 60-76 μ longum, 53-76 μ latum; membrana minute delicatissime granulosa; granulis irregulariter vel in striis longitudinalibus dispositis(Pl. lv., f.2). Epivalva conica vel rotunda; apice interdum crenâ, vulgo præterea dentibus binis instructa; tabulis æquatoriis 7, tabulis apicalibus semper plus minus irregulariter dispositis. Hypovalva rotunda; interdum margine posteriore concavo, sæpe dentibus vel spinis minutis binis utrinque ornato; tabulis æquatoriis 5, antapicalibus 2; fossa longitudinali valde dilatata.

The granulation is very often in indistinct longitudinal lines—a hint that it is the origin of the following form. The intercalary zones are, in this variation, generally reduced to a mere ridge, even in specimens of the largest size, showing that growth has been taking place in all parts of the membrane, and not at the intercalated strips only, as has been supposed. It is probably this general growth of the cell, as a whole, that has prevented the formation of the incrassate, areolate membrane of the type, which is very much smaller.

Var. WESTII(Lemm.) mihi, forma AUSTRALIS, n.f.
(Pl. lv., figs.5-9).

Long. 44-54; lat. 42-59 μ.

Cf. W. & G. S. West, Plankt. Scott. Lochs, Trans. R. Soc. Edin., xli., No.21, p.495.

The dimensions agree exactly with the Scottish form. The intercalary strips are not present in our specimens, except those that divide the equatorial from the apical and antapical plates, which are sometimes indicated as incrassate ridges(Pl.lv., figs.8,9). The disposition of the plates in the Scottish form agrees, in general, with that of *P. tabulatum* var. *granulosum*(Pl.lv., figs.2*b*, 3*c*), of which our *P. tabulatum* var. *Westii* is certainly an incrassate variant, specimens having been noted with the membrane of an intermediate character(Pl. lv., f.4*f*). The ridging, also, of the membrane, in our forms, is more accentuated, straighter, and hardly ramified at all; but, at the same time, I consider the ridged membrane itself so characteristic of this variation, as to outweigh all other differences. The two apical teeth of var. *granulosum* are sometimes present.

Var. ZONATUM, n.var. (Pl. lv., figs.10-12).

Forma globosa; fossa transversa centrali; membrana glabra; tabulis æquatoriis omnibus tæniis rectis parallelis incrassatis binis, transverse dispositis, ornatis; tabulis apicalibus antapicalibusque vulgo confusis, membranâ ut in var. *Westii*.

Long. 54; lat. 50-59 μ.

Filter-samples, 100, 102, 115.

The connection of the three foregoing forms with one another and with *P. tabulatum*, is well shown by the figure in Pl.lv., f.3*b*. The shape and tabulation, both front and back, are those of *P. tabulatum*; the marking of the membrane, in general, is that of var. *granulosum*; while at x, there is a distinct transverse ridge as in var. *zonatum*, and here and there, especially just below the transverse groove, are clear traces of the longitudinal ridges of var. *Westii*.

Var. HIEROGLYPHICUM, n.var. (Pl. lv., f.13).

Forma globosa; fossa transversa centrali; membrana glabra; tabulis æquatoriis solis formatis, notis hieroglyphicis disjunctis ornatis. Zonis intercalaribus latissimis, rugis incrassatis paucis transverse ordinatis instructis. Partibus apicalibus antapicalibusque rugis ornatis.

Long. 54; lat. 54 μ. Cum priori.

Var. OVATUM, n.var. (Pl. lv., f.14).

Forma ovata; fossa transversa centrali; membrana glabra; epivalva conica; hypovalva rotundo-conica; tabulis a rugis minute-granulatis definitis.

Long. 50; lat. 46 μ. Filter-sample 115.

Cf. Penard, Perid. du Leman, Pl. iii., f.9, for a similar ridging.

Var. INTERMEDIUM, n.var. (Pl. lv., figs.15, 16).

Formæ inter var. *africanum* et var. *granulosum* intermediæ, ovales; fossa longitudinali valde dilatata; tabulis plus minus inchoatis; membrana glabra.

Long. 42-44; lat. 29-40 μ. Filter-samples 100, 102.

Var. AFRICANUM(Lemm.) mihi, forma. (Pl. lv., f.17).

Long. 30-32; lat. 27-28 μ Filter-sample 66.

Cf G. S. West, Third Tanganyika Exp., Pl.9, f.1. This is a young stage of growth intermediate in position between var. *intermedium* above, and var. *pusillum*(Penard). Its likeness, in shape, to the latter, in our specimens, is very decided, especially in the excavation at the back of the hypovalve, which marks the position of the greatly dilated longitudinal furrow. Also in the rectangular produced apex of the epivalve, which sometimes shows the two minute teeth of var. *granulosum*, the full-grown form

Var. CAUDATUM, n.var. (Pl. lv., f.18).

Forma ovata, var. *africano* proxima; membrana glabra; tabulis non perfecte definitis. Epivalva apice producta; hypovalva a tergo dentibus binis instructa.

Long. 30; lat. 21 μ. Filter-sample 66.

Var. PUSILLUM (Penard) mihi, forma MORSA, n.f.
(Pl. lv., f.19-21).

Forma hypovalva a tergo oblique excavata.

Long. 20-24; lat. 16-18 μ. No 66.

Cf. *P. pusillum* Penard, 1891, Perid. du Leman, Pl. iv., f.1-3; *P. javanicum*, 1908, Protococc. et Desm., Pl. xvi., f. 575-578. The inter-tabular ridges are, in some cases, faintly indicated in the epivalve. *P. inconspicuum* Lemm., and *P. minimum* Schilling, and *P. Orrei* Huitfeldt-Kaas, are variants of this stage of development.

Var. INCONSPICUUM (Lemm.) mihi, forma. (Pl. lv., f.22).

Forma hypovalva a tergo oblique excavata.

Long. 20; lat. 16-18 μ. Nos.90, 100.

Cf. G. S. West, Alg. Yan Yean Res., p.81, figs. H-J.

Having now traced the development of *P. tabulatum* var. *granulosum* through various representative stages of growth, down to *P. inconspicuum* Lemm., 20 × 16 μ I think it well to finish the life-history by adding the development of the latter (or a form of it) from the resting cell. In Pl. lvii., f.4*a*, is the resting cell (lat. 16 μ), the outcome of a zoospore; while *b* (lat. 16 μ) and *c* (20 × 12) show its development into the *peridinium*-shape, by indication of the transverse furrow near one end. In *d* (18 × 18 μ) the transverse furrow is distinct, with the conical epivalve and excavated hypovalve seen in our form of *P. inconspicuum*. These forms were obtained in a single gathering from a piece of swampy ground at Auburn. The cells were alive, but not yet motile.

Genus GYMNODINIUM Stein.

GYMNODINIUM FUSCUM var. CORNIFAX (Schilling).

(Pl. lvii., f.18,19).

Cell. long 56; lat. 38; cyst long. 45-60; lat. corp 22-30 μ.

Synonyms of the cysts are *Cl. cancer* Playf., *antea*, 1907, Pl. ii., f.16; also *Reinschiella Siamensis* and *R. obesa* W. & G. S. West, Flora of Koh Chang, T.4, f.52-54. *Gym. fuscum*, *G. cornifax*, *G. uliginosum*, and *G. neglectum* are all forms of the same species. The last occurs here also. If the cytoplasm extends right up into the tips of the cyst, *G. fuscum* results, otherwise one of the others. Cf. Schilling, Süssw. Peridineen, T. iii., f.1,9,16,17,18.

VERMES.

ANGUILLULA FLUVIATILIS Müller.

In large specimens, especially when dead, the cuticle may sometimes be observed to be transversely striate. The striæ are fine and very faint. Closer investigation shows them to be composed of rows of minute puncta, which, like those forming the striæ in the infusoria, seem to be caused by some differentiation within the membrane.

ROTATORIA.

LINDIA TORULOSA Dujardin. (Pl. lvii., f.9).

Found in the pond formed by the washing of the filter-screens, in company with *Copheus spicatus*, of which it seems to be the outgrowth. The toes are turned back over the body, and are quite useless; the creature moves like a worm. On the hindmost segment is a pair of the same processes, which give the name to *Copheus spicatus*; and, at irregular intervals down the sides, are short fusiform spine-like processes. They seem too regularly placed to be fungous growths, but do not appear to penetrate the epidermis. The red spot was large and cup-shaped. It is undoubtedly a gland connected with the circulatory system. At intervals of, say, one minute, a pink flush would appear in the vessel surrounding it; and that this was caused by an emanation from the red gland, was evident, since, on more than one occasion, I observed minute grains of its substance to break off from the thin edge of the cup and float away in the lymph, dissolving as they went, with the production of the same pink colouration.

INFUSORIA.

TRACHELOMONAS CAUDATA (Ehr.) Stein, var. ELEGANTISSIMA (G. S. West) mihi.

Long. 38; lat 9 μ. (Pl. lvii., f.11).

Syn., *Dinobryon elegantissimum* G. S. West, Alg. Yan Yean Res., p.81, fig.10K. A large number of variations of *Trach. caudata* were lately obtained from a plankton-gathering in the Parramatta River (fresh). The form nearest to var. *elegantissima*, is figured in Pl. lvii., f.10. It is a stipitate *Trachelomonas*, the tail being the remains of the stipes when the organism breaks away. The size of the specimen figured was long. 34, lat 18 μ. As I have seen no figure of *Tr. caudata* Ehr., nor yet of *Tr. acuminata* Schmarda, the description of which equally well suits my specimens, I cannot be quite certain of the identification

Menoidium pellucidum Perty var. inflatum, n.var.

(Pl. lvii., f.22).

Forma brevior; dorso plus arcuato; rostro angustissimo minuto aut nullo. Long. circa 50 μ.

Mallomonas splendens (G. S. West) mihi.

(Pl. lvii., f.12,13).

Long. corp. 30-56; lat. 9-13; setæ long. ad 36 μ.

Syn., *Lagerheimia splendens* G. S. West, Alg. Yan Yean, Pl.6, f.4-8.

Found in the plankton (only dead and empty tests, however) in considerable quantity. There is nothing to distinguish the empty test from a *Lagerheimia*. Finding the creature alive (Pl. lvii., f.12) at Gardener's Road swamps, however, left no room for doubt. The spinous setæ, which are capable of a slight amount of lateral movement, vary in number from two to five (six?) each end, and there are two contractile vesicles, one each side, one-third of the length from the hinder end. In many specimens, the spines were without extended bases, growing directly out of the body. I had felt it necessary, at first, to identify this species with *M. litomesa* Stokes, Infus. U.S., Pl. i., f.32, but he states (pp. 92-93), that the cuticular surface is finely crenulate, with non-vibratile setose hairs. This shows that *M. litomesa* is a form of *M. Plosslii* Perty, which I have often found quite devoid of hairs. *M. splendens* is never crenulate, though the edge appears somewhat irregular owing to the criss-cross furrows, and the setæ are distinctly spinous.

CHLAMYDOMONAS INTERMEDIA Chodat. (Pl. lvii., f.14).

Cœnob. diam. 53; cell. long. 13, lat. 10 μ.

CHLAMYDOMONAS sp. (Pl. lvii., f.15).

Cœnob. diam. 38; cell. long. 12, lat. 7 μ.

This cœnobium was peculiar in being disciform—the cells all on the same plane. I am of opinion that *Gleocystis* and *Sphærocystis* are young, vegetative stages of *Chlamydomonas*.

COTHURNIA AMPHORELLA Maskell, Trans. N.Z. Inst., 1887.

Long. 75-90; lat. max. 30-34; lat. or. 16-24 μ.

The foot is an extension of the body-plasma through a minute orifice at the hinder end. If the organism, while young, chances to get fixed on its side, it can form no pedicel. In this condition, it seems to be the same as *Platycola decumbens* Ehr. The lorica is, at first, pale straw colour, but changes with age to a deep red-brown. (Pl. lvii., f.20,21).

RHIZOPODA.

PELOMYXA PALUSTRIS Greef var. ECHINULATA, n.var.

(Pl. lvii., f.16,17).

Forma matura, oblonga, setis spinosis curvatis brevibus dense obtecta.

Long. ad 100; lat. ad 40-50; spin. long. ad 20 μ.

Obtained from the pond at Pott's Hill, and the tank in the Botanic Gardens. Smaller specimens, without spines, were observed in the same water. Some were noted, also, with the spines very faint, of a mucous character, only noticeable on close observation.

EXPLANATION OF PLATES LIII.-LVII.

Plate liii.

(All figures magnified 700 diams.).

Figs.1-2.—*Lagerheimia ciliata* (Lagerh.) Chodat.
Fig.3.———————— var. *coronata*, n.var.
Figs.4-5.———————— var. *inflata*, n.var.
Fig.6.———————— var. *amphitricha* (Lagerh.)
Fig.7.———————— var. *genevensis* (Chodat).
Figs.8-9.———————— var. *inermis*, n.var.
Figs.10-12.———————— var *gracilis* mihi.
Figs.13-19.———————— var. *acuminata*, n.var.
Fig.20.————————var. *globosa*, n.var.
Fig.21.————————var. *cristata*, n.var.
Figs.22-25.———————— var. *striolata*, n.var.
Fig.26.————————var. *comosa*, n.var.
Fig.27.—*Lag. ciliata* var. *acuminata*+var. *subsalsa* (Lemm.) f.
Fig.28.———————— var. *subsalsa* (Lemm.)+type.
Figs.29-38.———— various types of mother-cells.
Fig.39.—*Golenkinia radiata* var. *paucispina* (W. & G. S. West).
Fig.40.————————var. *australis*, n.var.

Plate liv.

Fig.1.—*Doc. trabecula* var. *Delpontei*, sixth recorded apex(×528).
Fig.2.—*Spirotænia minuta* Thuret (×700).
Fig.3.———————— *bispiralis* var. *fusiformis*, n.var. (×350).
Fig.4.—*Gon. Kinahani* var. *Kjellmanni* (Wille)(×350).
Fig.5.————————var. *tenuissimum*, n.var. (×700).
Fig.6.—*Pen. polymorphum* var. *cylindraceum*, n.var. (×560).
Figs.7-8.———————— var. *Mooreanum* (Arch.), (8) constricted form (×700).
Fig.9-10.———————— var. *minutissimum* (Nord.), (10) constricted form (×1000).
Fig.11.———————— var. *Turneri* mihi (×1000).
Fig.12.—*Cos. capitulum* var. *detritum*, n.var. (×700).
Fig.13.———— *ellipsoideum* var. *subfoveatum*, n.var. (×528).
Fig.14.———————— var. *subellipticum*, n.var. (×528).
Fig.15.————*anisochondrum* var. *confusum*, n.var. (×700).
Fig.16.————*Meneghinii* var. *Regnellii* (Wille) formæ (×1000).
Fig.17.———— *binum* var. *fontense* (Playf.) (×560).
Fig.18.—*St. connatum* var. *muticum*, n.var. (×700).
Fig.19.——— *margaritaceum* var. *cruciatum*, n.var. (×700).
Fig.20.——— *paradoxum* var. *perornatum*, n.var. (×528).
Fig.21.———*pseudosebaldi* var. *coralloideum*(Playf.) forma (×700).
Fig.22.————————var. *planktonicum* Playf., *antea* 1908, p. 621 (×528).
Fig.23.——— *volans* var. *elegans* Playf. (×700).

Fig.24.—*St. volans* var. *trigonum*, n.var. (×700).
Fig.25.——*orbiculare* var. *protractum*, n.var. (×528).
Fig.26.————mixed form: type (*a*)+var. *protractum* (*b*), both budding into processes (var. *germinosum* Playf.). The fullgrown form, *St. leptacanthum* Nord., is common in a tank in the Botanic Gardens, supplied solely by Sydney water (×528).
Fig.27.—— *orbiculare* var. *planktonicum*, n.var. (×700).
Figs.28-29.—*Eu. quadratum* Nord. var. *intermedium* Playf., *antea* 1908, p.609. (29) End view (×528).
Fig.30.———— var. *perornatum* Playf., *l.c.*, p.608, end view (×528).
Fig.31.—*Micr. truncata* mixed form: (*a*) var. *decemdentata* (Näg.)+(*b*) var. *incisa* (Bréb.) (×430).

Plate lv.

(Figures magnified 350 diams., unless marked otherwise.)

Fig.1.—*Peridinium tabulatum* var. *granulosum*, n.var.
Fig.2———— another cell with granules in lines; (*a*) membrane (×700), (*b*) diagram of hypovalve.
Fig.3.————another specimen; (*a*) obverse, (*b*) reverse, (*c*) diagram of epivalve, (*d*) diagram of hypovalve.
Fig.4.———— another cell, strongly but irregularly granulate; (*a*) obverse, (*b*) reverse, (*c*) hypovalve, (*d*) epivalve, (*e*) epivalve of another cell, (*f*) membrane intermediate in character between var. *granulosum* and var. *Westii* (×700).
Fig.5.———— var. *Westii* (Lemm.) forma *australis* (×450); (*a*) obverse, (*b*) reverse.
Fig.6.———— a smaller, less corrugated cell; diagram of epivalve (×528).
Fig.7.————another cell, obliquely tilted, showing the apex of var. *pusillum* (Penard) (×528).
Fig.8.————another cell, hypovalve (×528).
Fig.9.————another cell, hypovalve (×350).
Fig.10.———— var. *zonatum*, n.var.
Figs.11-12.————two slightly different hypovalves.
Fig.13.———— var. *hieroglyphicum*, n.var.
Fig.14.———— var. *ovatum*, n.var.
Figs.15-16.———— var. *intermedium*, n.var., two forms (×528).
Fig.17.———— var. *africanum* (Lemm.); (*a*) obverse, (*b*) reverse (×700).
Fig.18.———— var. *caudatum*, n.var., two forms; (*a*) obverse, (*b*) reverse (×700).
Figs.19-21.———— var. *pusillum* (Penard) forma *morsa*, three cells (×700).
Fig.22.————var. *inconspicuum* (Lemm.) forma (×700).

Plate lvi.

Fig.1.—*Pedi. tetras* var. *longicornutum* (Rac.)(×1350).

Fig.2.———————— var. *australe*, n.var. (×1500).

Fig.3.———————— var. *tetrapedia* (Kirchn.) (×1500).

Fig.3*a*.———————— var. *quadratum*, n.var. (×1500).

Fig.4.———————— var. *unicellulare*, n.var. (×1500), (*a*) side.

Fig.5.———————— var. *triangulare* (Chodat) (×1500).

Fig.6.———————— var. *Crux Michaeli* (Rein.) (×700).

Fig.7.———————— var. *integrum* (Näg.) f. (×700).

Fig.8.—*Scene. obliquus* var. *acuminatus* (Lag.) Chod.(×528).

Fig.9.———————— var. *inermis*, n.var. (×528).

Fig.10.—*Tetraëdron lobulatum* var. *decussatum* (Rein.) f. (×700).

Fig.11.———————— var. *triangulare*, n.var. (×700).

Fig.12.—*Chætosphæridium globosum* var. *microscopicum*, n.var. (×350).

Fig.13.—*Scyt. mirabile* (Dillw.) Bornet; (*a*) narrow, crowded cells resulting from mitosis, (*b*) cells developing freely, (*c*) var. *amplum* (West), (*d*) var. *ambiguum* (Kütz.), (*e*) heterocyst of the type-form; (*c*) and (*d*) are the result of a current of water drawing the cells out—the heterocysts are similarly lengthened. These three types were all found succeeding one another in the same filament within ½mm. (×350).

Figs.14-16.—*Calothrix confervicola* (Roth.) Ag. (×350).

Figs.17-18.—*Oscillatoria nigroviridis* Thw. var. *australis*, n.var. (×350).

Fig.19.—*Stenopterobia anceps* (Lewis) Bréb. (×350).

Fig.20.———————— var. *intermedia* (Lewis) (×350); (*a*) apex in side-view (×700).

Fig.21.———————— var. *Heribaudii* mihi, slender form, no puncta (×350).

Fig.22.————————————robust form; (a) with marginal dots, (*b*) with arches (×700).

Fig.23.———————— var. *detrita*, n.var. (×700).

Fig.24.—*Cycl. Meneghiniana* var. *minutissima*, n.var. (×1000); (*a*) side.

Fig.25.———————— var. *major*, n.var. (×528); (*a*) side.

Fig.26.———————— var. *stelligera* Cleve et Grun. (×700).

Fig.27.———————— var. *Kützingiana* (Thw.) (×700).

Fig.28.———————— Schröter's form, *quadrijuncta*(×700).

Figs.29-31.—*Rhizosolenia eriensis* var. *morsa* W. & G. S. West; (29) (×1000), (30) a very small form (×700), (31) large broad form (×528).

Fig.32.—*Rhizo. eriensis* var. *morsa*, a specimen which shows that the diatom twists round its long axis to form those frustules with the spines on opposite sides. From nature (×700).

Figs.33-35.——————— var. *Zachariasi* (Brun)(×528); frustules with inchoate corners growing into a perfect rectangle prior to deduplication.

Figs.36-38.——————— var. *Zachariasi* (Brun)(×700). From Brisbane.

Fig.39.——————— var. *gracilis* (H. L. Smith)(×528).

This series furnishes indisputable evidence of the growth of the diatomic membrane.

Plate lvii.

Figs.1-3.—*Peridinium tabulatum* (Ehr.); (1) obverse, (2) hypovalve, (3) epivalve (×528).

Fig.4.—Stages in the development of *Peridinium* from the resting cell. (*a*) Resting cell, (*b*) (*c*) (*e*) the formation of hypovalve and epivalve, (*d*) the simple *Peridinium* shape. All non-motile (×528).

Fig.5.—*Dinobryon sertularia* Ehr., forma (700).

Fig.6.——————— var. *cylindricum* (Imhof) (×700).

Fig.7.——————— var. *divergens* (Imhof) (×700).

Fig.8.——————— var. *Schauinslandii* (Lemm.)(×700).

Fig.9.—*Lindia torulosa* Dujardin; (*a*) jaws.

Fig.10.—*Trachelomonas caudata* (Ehr.) Stein (×700).

Fig.11.——————— var. *elegantissima* (G. S. West) (×700).

Fig.12.—*Mallomonas splendens* (G. S. West), living specimen from Botany swamps, chromatophores omitted (×700).

Fig.13.——————— two empty tests from the plankton (×528).

Fig.14.—*Chlamydomonas intermedia* Chodat; (*a*) (×700), (*b*) globular cœnobium of 16 cells (×528).

Fig.15.——————— sp. An 8-celled *disciform* cœnobium (×700).

Figs.16-17.—*Pelomyxa palustris* Greef var. *echinulata*, n.var.; (16) a large specimen just divided (×350).

Fig.18.—*Gymnodinium fuscum* var. *cornifax* (Schilling) (×350).

Fig.19.——————— encysted (×528); (*a*) another cyst in back view, development more advanced (×528).

Fig.20.—*Cothurnia amphorella* Maskell; full-grown forms (×350).

Fig.21.——————— (*a*) Maskell's type, a young specimen; (*b*) one that has become fixed by the side (×350).

Fig.22.—*Menoidium pellucidum* Perty var. *inflatum*, n.var.(×400).